

Appl. No. : 09/855,321
Filed : May 14, 2001

REMARKS

Claims 17-43 are pending in the present application and stand rejected. The claims have been amended to clarify that the reaction space defines a reaction space volume. In addition, Claims 17, 20-22 and 41 have been amended to recite moving two reaction space volumes of gas through the reaction space during the interval between pulses of reactants. Claims 18, 19, 34, 35 and 43 have been similarly amended to recite moving 3 or 3-10 reaction space volumes of gas through the reaction space. Dependent Claims 23, 24, 26 and 27 have been amended for consistency. Applicants note that the term "evacuate" was clearly used synonymously with "remove" in the specification, and is in fact defined as such (p. 5, lines 26-27).

These amendments are fully supported by the specification and claims as filed and no new matter is added. For example, at page 8, lines 5-10 the specification recites providing a purge gas while removing from 2 to 10 reaction space volumes of gas from the reaction space during the interval between reactant pulses. Thus, one of skill in the art will recognize that the specification clearly supports the movement of from 2 to 10 reaction space volumes of gas through the reaction space. Each of the current rejections is discussed below.

Claim Rejections Under 35 U.S.C. § 112

Claims 17-43 were rejected under 35 U.S.C. § 112 for being indefinite. In particular the Examiner questions how a gas volume of the reaction space can be determined, when gases expand to fill the containers in which they are housed.

Applicants respectfully submit that it is common practice in the art to refer to the volume of gas that can be pumped from a container and that the scope of the claims will be readily apparent to the skilled artisan. Although the Examiner is correct that a gas will expand to fill the chamber in which it is housed, the amount of gas in the chamber at a given pressure is finite. That is, the number of molecules of gas is fixed. Thus, a reaction space volume of gas corresponds to a particular amount of gas at a given pressure. In fact, pumps that are used to remove gas are rated on the volume of gas that they can remove in a particular time period (for a given pressure). Thus, if a pump with a capacity of 1 L/minute is used to remove gas from a 1 L reaction space, a reaction space volume of gas will be removed for every minute that the pump is run. Again, the gas volume corresponds to a specific number of gas molecules at the particular pressure.

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The Examiner also states that a gas volume of the reaction space cannot be removed because a perfect vacuum does not exist and that it is not clear how three to ten gas volumes can be removed when the volume of the gas in the chamber remains constant. While the term "evacuate" was used in the claims, the skilled artisan will understand from the specification that this is possible in embodiments where an inert gas is provided to the reaction chamber while gas is simultaneously being removed from the chamber by a pump, i.e. the chamber inlet is not closed. See dependent Claims 22-23. For example, at page 5, line 22 through page 6, line 2 the specification provides a definition of "evacuation" as ""the removal of reactant residues in the vapor phase" and states that "when required the apparatus may be simultaneously filled with an inactive gas which promotes the purging of the reactant residues from the reaction space." That is, as gas is being removed, additional gas is being added to the chamber. The situation is no different from removing a volume of liquid from a container, where the container is continuously replenished.

In order to clarify that purge gas is being provided at the same time that gas is being removed from the reaction space, Applicants have amended the claims to recite moving two or more reaction space volumes of gas through the reaction space in the interval between reactant pulses. In addition, for further clarity Applicants have amended the claims to indicate that the reaction space defines a reaction space volume. As discussed above, at a particular pressure a reaction space volume of gas will be a specific amount of gas.

Embodiments in which an inert gas enters the chamber as reactant gas is pumped out (i.e., movement of gas through the chamber) are clearly disclosed in the specification. As a result, the recited movement of 2, 3, and 3-10 reaction space volumes of gas through the reaction chamber is definite and is enabled. Applicants note that because gas is being provided to the chamber concurrently with gas removal, in these embodiments there will be little pressure fluctuation and the amount of gas in the chamber volume will be approximately constant.

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Finally, the Examiner found the language "corresponding to" confusing. The current amendments specify that reaction space volumes of gas are being moved through the reaction space. These amendments are believed to address the Examiner's concerns..

Claim Rejections Under 35 U.S.C. § 103

Claims 17- 43 stand rejected as obvious over the combination of Nishizawa (U.S. Patent No. 4,975,252) in view of Sakuma (U.S. Patent No. 5,270,247) and Moore (3,662,583). In particular, the Examiner found that Nishizawa teaches a high-pressure evacuation of the chamber in an ALD process and concludes that the total volume of the reaction space would be essentially totally evacuated. Sakuma is cited for the proposition that reactant pulses should be separated as much as possible and Moore is cited for the teaching of oblong feed pipes.

Independent Claims 17 and 41 have been amended to recite evacuating a volume of gas equal to two gas volumes of the reaction space between reactant pulses. The relevant dependent claims have been adjusted accordingly. Applicants respectfully submit that Nishizawa fails to teach evacuating a volume of gas equal to two or more gas volumes of the reaction space, as claimed. Further there is no teaching or suggestion in Nishizawa to utilize a purge gas. Even if there was, there is no teaching or suggestion to utilize a sufficient quantity of purge gas such that evacuation of the reactant and the purge gas would be equivalent to evacuating two or more gas volumes of the reaction space.

This lack of teaching is not made up for by any of the secondary references. As the Examiner recognized in withdrawing the previous rejections, Sakuma (U.S. Patent No. 5,270,247) does not teach or suggest purging even a single gas volume of the reaction space. Similarly, Moore (U.S. Patent No. 3,662,583) has no relevant teachings. Thus, Applicants request withdrawal of the rejection.

Conclusion

In view of the arguments presented above, Applicants submit that the present application is in condition for allowance. If any issues remain, the Examiner is invited to contact Applicants' representative at the number provided below in order to resolve such issues promptly.

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Respectfully submitted,

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By:

A handwritten signature in black ink, appearing to read 'A. N. Merickel', written over a horizontal line.

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